WHAT IS CLAIMED IS:

1. A communication system for generating an OFDM signal having frequency tones distributed over a predetermined bandwidth, the communication system comprising:

an allocation circuit that defines an allocated tone set selected from frequency tones distributed over a predetermined bandwidth;

a mapping circuit that receives data symbols from a symbol constellation and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols;

an interpolation circuit that receives the discrete signal and generates a continuous signal by applying predetermined interpolation functions to the discrete signal, the interpolation functions operating on the discrete signal such that values of the continuous signal at the prescribed time instants are equal to the mapped symbols and a frequency response of the continuous signal includes sinusoids having non-zero values at frequency tones within the allocated tone set and zero values at the remaining frequency tones; and

a sampling circuit that samples the continuous signal at discrete time instants distributed over the time domain symbol duration to generate a digital signal sample vector.

2. The communication system of claim 1 wherein the discrete time instants are defined within the range of 0, T/N, 2T/N, …, T(N-1)/N, where N is a total number of time instants in the time domain symbol duration.

3. The communication system of claim 1 wherein the frequency tones within the allocated tone set are contiguous frequency tones, and the prescribed time instants are equally spaced and uniformly distributed over one symbol duration.

4. The communication system of claim 1 wherein the frequency tones within the allocated tone set are equally spaced frequency tones, and the prescribed time instants are equally spaced and uniformly distributed over a fraction of one symbol duration.

5. The communication system of claim 4 wherein a fraction of one symbol duration is defined by 1/L where L is the spacing between two adjacent allocated frequency tones in the allocated tone set.

6. The communication system of claim 1 wherein a total number of discrete time instants is greater than or equal to a total number of frequency tones distributed over the predetermined bandwidth.

7. The communication system of claim 1 wherein the interpolation circuit further includes a memory for storing the predetermined interpolation functions, and an interpolation function module for retrieving the interpolation functions from the memory and applying the interpolation functions to the discrete signal to generate the continuous signal.

8. The communication system of claim 7 wherein the interpolation functions comprise a matrix of precomputed sinusoidal waveforms.

9. The communication system of claim 7 wherein the interpolation functions comprise continuous interpolation functions.

10. The communication system of claim 1 wherein the mapping circuit replicates the discrete signal of mapped symbols to generate an infinite series of mapped symbols over prescribed time instants covering a time interval from $-\infty$ to $+\infty$.

11. The communication system of claim 10 wherein the interpolation functions comprise sinc interpolation functions, and the interpolation circuit applies the sinc interpolation functions to the infinite series of mapped symbols.

12. The communication system of claim 1 wherein the data symbols are complex symbols associated with a symbol constellation.

13. The communication system of claim 1 further including a digital signal processor for implementing the mapping circuit and the interpolation circuit.

14. The communication system of claim 1 further including a cyclic prefix circuit for receiving the digital signal sample vector from the sampling circuit and prepending a cyclic prefix to the digital signal sample vector.

15. The communication system of claim 14 wherein the cyclic prefix circuit operates to copy an end portion of the digital signal sample vector and prepend the end portion to a beginning portion of the digital signal sample vector.

16. The communication system of claim 1 further including a digital to analog converter operable to receive the digital signal sample vector and generate an analog signal for transmission within the communication system.

17. A communication system for generating an OFDM signal having allocated frequency tones distributed over a predetermined bandwidth, the communication system comprising:

a mapping module that receives data symbols from a symbol constellation and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols; and

an interpolation module that receives the discrete signal and generates a continuous signal by applying an interpolation function to the discrete signal;

wherein the interpolation function operates on the discrete signal such that a frequency response of the continuous signal includes sinusoids having non-zero values at the allocated frequency tones, and zero values at frequency tones other than the allocated frequency tones.

18. The communication system of claim 17 wherein the allocated frequency tones are associated with a designated transmitter within the communication system.

19. The communication system of claim 17 wherein the allocated frequency tones are contiguous frequency tones, and the prescribed time instants are equally spaced time instants uniformly distributed over one symbol duration.

20. The communication system of claim 17 wherein the allocated frequency tones are equally spaced frequency tones, and the prescribed time instants are equally spaced time instants uniformly distributed over a fraction of one symbol duration.

21. The communication system of claim 20 wherein a fraction of one symbol duration is defined by 1/L where L is the spacing between two adjacent allocated frequency tones.

22. The communication system of claim 17 wherein the interpolation function operates on the discrete signal such that values of the continuous signal at the prescribed time instants are equal to the mapped symbols.

23. The communication system of claim 17 wherein the interpolation module includes a memory for storing the interpolation function, the interpolation module retrieving the interpolation function from the memory and applying the interpolation function to the discrete signal to generate the continuous signal.

24. The communication system of claim 23 wherein the interpolation function comprises a sinc interpolation function.

25. A communication system for generating an OFDM signal having allocated frequency tones distributed over a predetermined bandwidth, the communication system comprising:

a mapping module that receives data symbols from a symbol constellation and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols; and

an interpolation module that receives the discrete signal and generates a digital signal sample vector by applying an interpolation function to the discrete signal;

wherein the interpolation function operates on the discrete signal such that a frequency response of the digital signal sample vector includes sinusoids having non-zero values at the allocated frequency tones, and zero values at frequency tones other than the allocated frequency tones.

26. The communication system of claim 25 wherein the interpolation module further includes a memory for storing the interpolation function, the interpolation module retrieving the interpolation function from the memory and applying the interpolation function to the discrete signal to generate a digital signal sample vector.

27. The communication system of claim 26 wherein the interpolation function is a discrete interpolation function comprising a matrix of precomputed sinusoidal waveforms.

28. The communication system of claim 27 wherein the interpolation module multiplies the matrix of precomputed sinusoidal waveforms with the discrete signal of mapped symbols over the time domain symbol duration to generate the digital signal sample vector.

29. A communication system for generating an OFDM signal having allocated frequency tones distributed over a predetermined bandwidth, the communication system comprising:

a mapping module that receives data symbols from a symbol constellation and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols; and

an interpolation module that receives the discrete signal and generates a continuous signal by applying an interpolation function to the discrete signal;

wherein the interpolation function operates on the discrete signal such that values of the continuous signal at the prescribed time instants are equal to the mapped symbols.

30. A communication system comprising:

a mapping circuit that receives data symbols and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols; and

an interpolation circuit that receives the discrete signal and generates a continuous signal by applying an interpolation function that operates on the discrete signal such that a frequency response of the continuous signal includes sinusoids having non-zero values at a first set of tones, and zero values at a second set of tones.

31. The communication system of claim 30 wherein the continuous signal comprises an OFDM communication signal.

32. The communication system of claim 30 wherein the first set of tones are allocated to one communication device within the communication system.

33. The communication system of claim 32 wherein the communication device comprises a transmitter.

34. The communication system of claim 30 wherein the interpolation circuit is adapted to store the interpolation function.

35. The communication system of claim 34 wherein the interpolation function is a sinc interpolation function.

36. The communication system of claim 34 wherein the interpolation function is a matrix of precomputed sinusoidal waveforms.

37. The communication system of claim 36 wherein the interpolation circuit multiplies the matrix of precomputed sinusoidal waveforms with the discrete signal of mapped symbols over the time domain symbol duration to generate the continuous signal.

38. The communication system of claim 30 further comprising a sampling circuit that samples the continuous signal at discrete time instants distributed over the time domain symbol duration to generate a digital signal sample vector.

39. The communication system of claim 38 wherein the discrete time instants are defined within the range of 0, T/N, 2T/N, …, T(N-1)/N, where N is a total number of time instants in the time domain symbol duration.

40. The communication system of claim 30 wherein the data symbols are complex symbols associated with a symbol constellation.

41. A communication system comprising:

a mapping circuit that receives data symbols and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols; and

an interpolation circuit that receives the discrete signal and generates a digital signal sample vector by applying an interpolation function that operates on the discrete signal such that a frequency response of the digital signal sample vector includes sinusoids having non-zero values at a first set of tones, and zero values at a second set of tones.

42. The communication system of claim 41 wherein the interpolation circuit is adapted to store the interpolation function.

43. The communication system of claim 42 wherein the interpolation function is a matrix of precomputed sinusoidal waveforms.

44. The communication system of claim 43 wherein the interpolation circuit multiplies the matrix of precomputed sinusoidal waveforms with the discrete signal of mapped symbols over the time domain symbol duration to generate the digital signal sample vector.

45. A communication system for generating an OFDM signal having a set of frequency tones distributed over a predetermined bandwidth, the communication system comprising:

a mapping circuit that receives data symbols from a symbol constellation and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols;

a DFT circuit that performs a discrete Fourier transform on the discrete signal to generate a frequency domain symbol vector representing a frequency response of the discrete signal at allocated tones;

a zero insertion circuit that manipulates the frequency domain symbol vector by inserting zero value symbols at frequency tones other than the allocated tones; and

an IDFT circuit that performs an inverse discrete Fourier transform to obtain a digital signal sample vector representing a continuous function.

46. The communication system of claim 45 further including a windowing circuit connected between the DFT circuit and the zero insertion circuit, the windowing circuit operable to receive the frequency domain symbol vector, cyclically expand the frequency domain symbol vector and apply a windowing function to the frequency domain symbol vector.

47. The communication system of claim 46 wherein the windowing function satisfies the Nyquist zero intersymbol interference criterion.

48. The communication system of claim 47 wherein the windowing function is a Fourier transform of a raised cosine interpolation function.

49. The communication system of claim 46 wherein a number of allocated tones is greater than a total number of data symbols to be transmitted in the symbol duration.

50. A method for reducing a peak-to-average ratio in an OFDM communication signal transmitted by a communication device, the method comprising:

providing a time domain symbol duration having equally spaced time instants;

allocating a predetermined number of frequency tones to the communication device;

receiving as input data symbols to be transmitted by the OFDM communication signal;

mapping the data symbols to the equally spaced time instants in the symbol duration to generate a discrete signal of mapped symbols;

generating a continuous signal by applying an interpolation function to the discrete signal, the interpolation function operating on the discrete signal such that a frequency response of the continuous signal includes sinusoids having non-zero values at the allocated frequency tones, and zero values at frequency tones other than the allocated frequency tones; and

sampling the continuous signal at discrete time instants distributed over the time domain symbol duration, to generate a digital signal sample vector.

51. The method of claim 50 wherein the discrete time instants are defined within the range of 0, T/N, 2T/N, ..., T(N-1)/N, where N is a total number of time instants in the symbol duration.

52. The method of claim 50 wherein the step of allocating a predetermined number of frequency tones to the communication device further comprises allocating contiguous frequency tones to the communication device.

53. The method of claim 50 wherein the step of allocating a predetermined number of frequency tones to the communication device further comprises allocating equally spaced frequency tones to the communication device.

54. The method of claim 50 further including the step of replicating the mapped symbols within the symbol duration to generate an infinite series of data symbols over

equally spaced time instants covering a time interval from -∞ to +∞ after the step of mapping the data symbols.

55. The method of claim 54 wherein the step of generating the continuous signal further comprises applying a sinc interpolation function to the infinite series of data symbols.

56. The method of claim 50 wherein the discrete signal of mapped symbols includes odd numbered symbols and even number symbols, and further comprises the step of phase rotating each even numbered symbol by $\pi/4$.

57. The method of claim 50 further comprising the step of mapping the data symbols to a block of complex data symbols wherein the block of complex data symbols includes odd numbered symbols and even numbered symbols;

phase rotating each even numbered symbol by $\pi/4$; and

mapping the block of complex data symbols to equally spaced time instants in the symbol duration to generate the discrete signal of mapped symbols.

58. The method of claim 50 further comprising the step of offsetting imaginary components of the digital signal sample vector by a predetermined number of samples for producing a cyclic offset in the digital signal sample vector.

59. The method of claim 58 further comprising the step of fixing a position of real components of the digital signal sample vector with respect to the imaginary components.

60. The method of claim 58 wherein the predetermined number of samples is an integer number of samples.

61. The method of claim 58 wherein the predetermined number of samples is a fraction of one sample period.

62. The method of claim 50 further comprising the step of prepending a cyclic prefix to the digital signal sample vector.

63. The method of claim 62 wherein the step of prepending a cyclic prefix further comprises copying an end portion of the digital signal sample vector and prepending the end portion to a beginning portion of the digital signal sample vector.

64. The method of claim 50 wherein the step of allocating a predetermined number of frequency tones includes allocating more tones than a total number of data symbols to be transmitted in the symbol duration.

65. The method of claim 50 wherein the interpolation function is a raised cosine function.

66. The method of claim 50 further comprising the step of precomputing the interpolation function and storing the interpolation function in a memory.

67. A method for reducing a peak-to-average ratio in an OFDM communication signal having a set of tones distributed over a predetermined bandwidth, the method comprising:

defining a symbol duration for the OFDM communication signal;

defining time instants in the symbol duration;

allocating frequency tones from the set of tones to a particular communication device;

receiving as input data symbols from a symbol constellation, the data symbols being transmitted by the OFDM communication signal;

mapping the data symbols to the time instants to generate a discrete signal in the time domain;

generating a digital signal sample vector by applying interpolation functions to the discrete signal such that a frequency response of the digital signal sample vector includes sinusoids having non-zero values at allocated frequency tones, and zero values at frequency tones other than the allocated frequency tones.

68. The method of claim 67 wherein the step of allocating frequency tones further includes allocating contiguous tones, and mapping the data symbols to equally spaced time instants distributed over one symbol duration.

69. The method of claim 67 wherein the step of allocating frequency tones further includes allocating equally spaced tones, and mapping the data symbols to equally spaced time instants distributed over a portion of one symbol duration.

70. The method of claim 67 wherein the data symbols are complex symbols.

71. The method of claim 67 wherein the discrete signal includes odd numbered symbols and even number symbols, and further comprises the step of phase rotating each even numbered symbol by $\pi/4$.

72. The method of claim 67 further comprising the step of mapping the data symbols to a block of complex data symbols wherein the block of complex data symbols includes odd numbered symbols and even numbered symbols;

phase rotating each even numbered symbol by $\pi/4$; and

mapping the block of complex data symbols to equally spaced time instants in the symbol duration to generate the discrete signal.

73. The method of claim 67 further comprising the step of offsetting imaginary components of the digital signal sample vector by a predetermined number of samples for producing a cyclic offset in the digital signal sample vector.